ABSTRACT

One of two input bias states to a qubit semiconductor waveguide gate controls the transmission of charge carriers to the output of one of two parallel waveguides. Intermediate the ends of the waveguides is a coupling. It permits charge carriers introduced at the input of one of the waveguides to either pass directly along that waveguide to an output end thereof or to move to the other waveguide to be received at that waveguide's output end as determined by an electrical or magnetic bias applied to the device. Acting thus, the gate can be used as a gate in quantum computation. For purposes of encryption, spin polarization of the carriers is controlled. The carriers (electrons, for example) can be in polarized to a single up or down spin condition at a quantum point contact by application of a magnetic field or they can be left unpolarized. The alternative appearance of the carriers at the first or second waveguide output and the spin polarization or lack thereof afford two binary nonorthogonal characteristics of a digital communication under the control of the sender. This permits known cryptographic techniques to be applied to develop an encryption key and encrypt communications between sender and receiver. Attempted decryption by any unauthorized person will be apparent. In an exemplary embodiment the first waveguide is of a uniform width, 35 nm, the second waveguide increases in width, from 25 nm at the input side of the gate to 45 nm at the output side of the coupling. The coupling, a tunneling region, is 335 nm in length.